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ABSTRACT

Aptitude-treatment interaction (ATI) methodology was used to assess the effectiveness of secondary teacher inservice training in reading instruction and to test the hypothesis that low-ability secondary students benefit most from directive teaching. For the first part of the study, 39 teachers were placed into two groups. One group received training in classroom behavior previously found to be predictive of reading gains; the other group was only observed. The results suggested that effective training methods are reflected in an altered relationship between teacher traits and classroom processes. In the second part of the study, the presence of an ATI between student ability and the directiveness of instruction was explored by creating an index of the directiveness of instruction, classifying classrooms as being either high or low on directiveness, and assessing the ability/achievement relationship within each group. Only tentative confirmation was established for the hypothesis. (FL)

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Aptitude-Treatment Interactions in a Study of Teaching Basic Reading Skills in Secondary School

by

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The purpose of this paper is to report on the presence of aptitude-treatment interactions (ATI) in a study of the teaching of remedial reading to secondary school students. This report represents an extended analysis of data collected by Stallings, Needels and Stayrook (1979). Specifically this study will address two issues involving ATI. The first issue is whether there are teacher trait and classroom behavior relationships that are changed as a result of the in-service training given to teachers. This is an issue regarding for whom the training was most effective and how effective it was overall. In this study one group of teachers received training in classroom behaviors previously found to be predictive of reading gains, while the other group was observed only and is termed the control group.

Training effectiveness is exhibited by a change in the relationship between teacher traits and classroom behaviors. There are two major assumptions being made in this ATI study of training effectiveness. One assumption is that there exists stable relationships between teacher traits and teacher classroom behaviors, and the second is that the control group of teachers represents a larger population of "untreated" teachers. The procedure for assessing effectiveness of training is to compare the trait-process relationship in the trained group with that of the control group. Differences between the groups in the trait-process relationships indicates that the training was powerful enough to alter trait-process relationships that would have occurred naturally. In other words, the trained teachers were exhibiting behaviors they wouldn't ordinarily exhibit.

The second ATI issue addressed in this study is the testing of the hypothesis that lower ability students learn more in a classroom environment where there is more direct instruction occurring. Some prior research reviewed in Cronbach and Snow (1977) suggest that lower ability students learn best in an environment that is more structured, provides more learning aids to the student and helps the student organize the content to be learned. The hypothesized reason is that lower ability students lack the necessary cognitive abilities to comprehend and integrate the content of instruction and hence need to have a structured environment provided for

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them. Higher ability students, on the other hand do not need the structure to learn, presumably because they are able to provide the structure for themselves.

Method

The data collected for this study comes from the larger study (Stallings, Needels and Stayrook, 1979). To summarize the methods, the study was conducted over the course of a school year. Originally, 51 teachers were to participate, but because of attrition during the school year and missing data, only 39 teachers are included in these ATI analyses. The teachers and their students were given questionnaires at the beginning of the fall semester, and at the end of the school year. Additionally students were tested at the beginning of the second semester. Teachers were randomly assigned to trained or control conditions following initial pretesting. The trained teachers received a series of workshops designed to increase behaviors found to be predictive of learning gains. The control teachers were observed only. All teachers were observed on three occassions during the school year, once prior to any training, once immediately following training (in January and February) and once midway through the second semester.

Because of a high turnover rate of students between semesters, only data for the second semester will be used in these analyses. Table 1 lists the variables measured and their definitions.

Originally there were 258 classroom process variables measured by the SRI Secondary Observation Instrument. From the list of 258, 16 classroom processes were selected as being the best representatives of the kinds of behaviors being taught in the in-service training workships. Table 1 lists the 16 classroom processes. Also in Table 1 is the list of the 4 teacher traits measured on the teacher questionnaire, and the pretest and posttest student test variables.

Results

Results concerning effectiveness of training will be presented first, followed by the test of the ATI hypothesis concerning low ability students and directive instruction.

Table 2 portrays the relations between teacher traits and classroom behaviors separately for the trained and control teachers. The data presented

in this table is meant to be suggestive rather than definitive. The sample sizes (22 trained, and 17 control teachers) are too small to make any firm conclusions regarding ATI. A few relationships are, however, worth noting.

In the control group, the relation between the teacher's philosophy toward teacher-centered versus student-centered instruction (Phil) and reading aloud (S4) is moderately positive (r = .32). This means that teachers who report they are more teacher-centered tend to have students reading aloud more often, and teachers with a student centered philosophy of teaching tend to have less reading aloud occurring in their classrooms. For the trained teachers this relationship is negative (r = -.35). Teachers in the trained group were instructed to increase the amount of reading aloud in their classrooms. The reversal of the relationships in the trained group suggests that the student-centered teachers in the trained groups are using more reading aloud as a result of the training and the teacher-centered teachers are using less.

Another interesting relationship is that between teacher trait anxiety (ANX) and the total number of positive behaviors exhibited in the classroom (F99). In the control group the correlation is .50, while for the trained teachers the correlation is -.18. For the control teachers there appears to be a strong relation between anxiety and positive behaviors. The training seems to have attenuated the relationship for trained teachers. A correlation of -.18 with an N of 22 teachers is virtually zero. The training seems to have been effective in increasing the amount of positive behaviors for low anxious teachers in the trained group.

The issues of an ATI between student ability and the directiveness of instruction was explored by creating an index of the directiveness of instruction, classifying classrooms as being either high or low on directiveness and assessing the ability-achievement relationship within each group. If the correlation between prior ability and achievement is lower in the high directive treatment, then this supports the notion that low ability students will do better in more directive classrooms.

The first step is to create a composite index of directive instruction. A factor analysis of the 16 observation variables was performed and the three factor solution rotated using the varimax technique. The results are

presented in Table 3. The first factor seems to represent a dimension called "directive recitation", wherein the variables of teacher questioning, student responding, teacher corrective feedback, teacher praise, individualization and readin interactions all cluster together. The second factor seems to represent teacher managing the classroom. The third factor is not used in these analyses.

Instead of computing factor scores based on the weights assigned to all 16 variables, the factor analysis was used to suggest which variables could be appropriately summed together to obtain a measure of "directive recitation" and "management". The specific observation variables were transformed into Z scores and summed with equal weights to obtain the composite score for each classroom.

For each composite score a frequency distribution was generated and high and low groups were defined. High "directive recitation" consisted of all classrooms (N = 16) whose composite score was greater than +2 Z-score units, low "directive recitation" classrooms (N = 18) had composite scores less than -2 Z-score units. For the "management" groups, 2 Z-score units was again used resulting in 13 high "management" classrooms and 19 low "managment" classrooms. Classrooms falling within 2 Z-score units of the mean were not used in the analyses.

Table 5 presents the results of the within group relationships between ability and achievement. For the high "directive recitation" condition the correlation of ability and achievement is .67. For the low "directive recitation" condition the correlation is .75. The difference between these two correlations is not large; however the sample sizes are reasonable. If we assume the population correlation to be .70, then with a sample of 200 the standard error of the correlation is .02. If we assume the population correlation to be 0.00, then with a sample of 200 the standard error is .07.

The difference between the correlations for the high and low "directive recitation" conditions is .08; hence, there may be reason to suspect that this is a real difference. The result is in the correct direction and offers tenative support for the hypothesis that low ability students can perform better in classrooms where the instructing style is more directive.

Differences between high and low "management" classrooms in terms

of aptitude-achievement relations is much less pronounced. No ATI conclusions are warranted.

Conclusions

The use of ATI methodology was explored in the assessment of training effectiveness. The results, although tenative, suggests that effective training methods are reflected in an altered relationship between teacher traits and classroom processes.

The testing of the hypothesis that low ability students benefit more from directive teaching was performed and only tenative confirmation established.

The testing of ATI in the field setting is a necessary step in the process of establishing generalizable ATI findings. Teaching is a complex social phenomenon with many interactions between learner characteristics and teaching methods. As these interactions become better understood our knowledge about effective teaching will increase. Gone forever will the the days of the "one best teaching method", and individualization of instruction will take on new meaning. Instead of individualizing meaning that students can go at their own pace through the same instructional materials, individualizing will mean students working through materials specifically adapted to their learning abilities and characteristics.

References

Cronbach, L.J. and Snow, R.,E., Aptitudes and Instructional Methods. New York: Irvington, 1977.

Stallings, J., Needels, P., and Stayrook, N., The teaching of basic reading skills in secondary school, Phase II, Final Report. Menlo Park, CA: SRI International, March, 1979.

Table 1

List of variables used in ATI study
and their definitions[1]

Classroom Process Variables:

S2 - Teacher without students in classroom management.
S3 - Total for activity: reading silently.
S4 - Total for activity: reading aloud.
S6 - Total for activity: instruction.
F5 - All adult to individual students, verbal.
F17 - Adult, commands, requests, and direct questions to students, reading.
F25 - Student responses to adult, reading.
F48 - Adult instructs a group, task or reading.
F56 - All social comments.
F71 - Adult praise and support, task or reading.
F76 - All adult corrective feedback, task or reading.
F94 - All classroom interactions, reading.
F96 - All classroom interactions, behavior.
F99 - All positive behavior.
F102 - All negative behavior.
F120 - All interactions regarding classroom assignments.

Teacher Questionnaire Variables:

Verbal - Teacher verbal facility as measured by a 10-item vocabulary test.
Anx - Teacher trait anxiety as measured by the Speilberger State-Trait Anxiety scale.
Motiv - Teacher self-reported use of 11 motivational techniques.
Phil - Teacher philosophical orientation toward teacher-centered vs. student-centered classroom management.

Table 1 (continued)

Student Test Variables:

RCOMP2 - Reading Comprehension scale from the California Achievement Test, CTB/McGraw-Hill, 1970. This test was given at the beginning of the second semester.

RCOMP3 - Reading Comprehension scale from the California Achievement Test, CTB/MCGRAW-Hill, 1970. This test was given at the end of the second semester.

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[1]Definitions taken from Stallings, Needels, and Stayrook, 1979.

Table 2

Relation of teacher traits to classroom behaviors for the trained and control teachers.

Trained Teachers N = 22								Control Teachers N = 17							
Teacher Trait			Classroom Behavior			Relationship		Teacher Trait			Classroom Behavior			Relationship	
Name	$\bar{X}$	SD	Name	$\bar{X}$	SD	r	raw slope	Name	$\bar{X}$	SD	Name	$\bar{X}$	SD	r	raw slope
Phil	29.1	6.3	S4	5.2	10.1	-.35	-.58	Phil	29.5	4.7	S4	6.1	9.6	.32	.68
Motiv	24.1	5.2	S6	13.7	10.8	.33	.57	Motiv	24.8	4.3	S6	11.0	10.8	.55	1.44
Anx	12.8	7.0	F5	71.4	29.9	-.06	-.26	Anx	10.5	6.0	F5	70.4	31.0	.22	1.00
Motiv	24.1	5.2	F17	31.5	13.0	-.18	-.44	Motiv	24.8	4.3	F17	24.9	15.6	.21	.80
Motiv	24.1	5.2	F25	28.8	12.3	-.19	-.43	Motiv	24.8	4.3	F25	24.3	14.9	.23	.81
Verbal	6.4	2.8	F56	6.1	10.5	.10	.39	Verbal	6.5	2.2	F56	8.3	9.6	.25	1.11
Anx	12.8	7.0	F71	14.7	6.3	-.29	-.25	Anx	10.5	6.0	F71	10.9	9.1	.28	.43
Motiv	24.1	5.2	F71	14.7	6.3	.08	.09	Motiv	24.8	4.3	F71	10.9	9.1	.30	.66
Phil	29.1	6.3	F76	12.7	7.2	.19	.23	Phil	29.5	4.7	F76	11.8	10.8	.43	1.03
Motiv	24.1	5.2	F94	197.2	55.1	-.11	-1.02	Motiv	24.8	4.3	F94	177.8	69.7	.24	3.91
Motiv	24.1	5.2	F96	5.8	6.8	.15	.15	Motiv	24.8	4.3	F96	7.5	11.3	-.25	-.68
Anx	12.8	7.0	F99	7.0	5.8	-.18	-.16	Anx	10.5	6.0	F99	6.6	5.4	.50	.46
Motiv	24.1	5.2	F99	7.0	5.8	-.55	-.64	Motiv	24.8	4.3	F99	6.6	5.4	.07	.09
Phil	29.1	6.3	F102	2.2	2.6	-.03	-.01	Phil	29.5	4.7	F102	3.1	8.2	.28	.50
Anx	12.8	7.0	F120	57.6	36.6	.30	1.60	Anx	10.5	6.0	F120	81.0	39.5	-.17	-1.12
Verbal	6.4	2.8	F120	57.6	36.6	-.07	-.96	Verbal	6.5	2.2	F120	81.0	39.5	.21	3.86

Table 3

Factor Analysis results on the 16 selected classroom process variables

Process Variable	Varimax Rotated Factor Loadings I	II	III
S2	-.22	.65	.14
S3	.06	.56	.49
S4	.25	-.18	-.24
S6	-.20	-.85	.29
F5	.57	.04	-.11
F17	.87	-.19	.04
F25	.95	-.13	.03
F48	.13	-.18	.31
F56	-.08	.26	-.14
F71	.73	-.36	.12
F76	.65	-.25	.04
F94	.85	-.05	.01
F96	.01	.05	-.74
F99	.18	-.02	-.18
F102	-.13	.40	-.03
F120	-.30	.78	.11

Table 4

Classroom process variables composing the "directive recitation" and "management" composite scores.

Directive Recitation	Management
F5 - Working with individual	S2 - Teacher in management
F17 - Teacher direct questioning	S3 - Reading silently
F25 - Student responding	S6 - Instructing*
F71 - Teacher praise	F102 - Negative Behavior
F76 - Teacher corrective feedback	F120 - Interactions about assignments
F94 - Total reading interactions	

*This process variable weighted negatively in creation of "management" score.

Table 5

ATI results for "directive recitation: and "management" groups on student reading comprehension test scores.

	Treatment Groups	
	High Directive Recitation	Low Directive Recitation
Number of Students	185	227
Correlation	.67	.75
Raw slope	.62	.76
	High Management	Low Management
Number of students	142	242
Correlation	.68	.73
Raw slope	.69	.70